IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of Robert J. Steger Application No.: 10/608,091 Filed: June 30, 2003 For: SUBSTRATE SUPPORT HAVING DYNAMIC TEMPERATURE CONTROL	**MAIL STOP APPEAL BRIEF - PATENTS** Group Art Unit: 1792 Examiner: RAKESH DHINGRA Confirmation No.: 8130

REPLY BRIEF

Commissioner for Patents
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Sir:

This is in response to the Examiner's Answer issued December 18, 2008.

OVERVIEW

Claim 1 is rejected over Yatsuda, Chiang and Ramanan on the basis that: (1) Yatsuda discloses heat transfer member **18** through which coolant is circulated in flow passage **34**; (2) Chiang discloses heat transfer member **110** through which fluid **76** is circulated for heating or cooling a substrate **8**; and (3) Ramanan discloses a low mass heating member **20** (Examiner's Answer at pages 5-7). The Examiner's Answer alleges that Ramanan's heating member **20** is less than ¼ inch thick for rapid heating/cooling of a workpiece (Examiner's Answer at page 7).

The Examiner's Answer fails to point out that Chiang uses massive cooling block **4** with cooling channels **78** and overlying heater block **6** with resistive heating element **72** to heat and cool the substrate (see FIG. 6) and Ramanan's heating member **20** is a laminate containing a resistance heater and that like Yatsuda and

Chiang, Ramanan utilizes a separate massive cooling block **26** (see FIG. 1C of Ramanan). No prior art reference cited in the Examiner's Answer discloses or suggests a heat transfer member having a flow passage and maximum thickness of ¼ inch wherein a controller is operable to circulate liquid through the flow passage so as to effect heating and cooling of the heat transfer member at a rate of about 0.25 to 2°C/sec. Likewise, the prior art applied against Claim 15 does not suggest a substrate support wherein liquid circulating through a heat transfer member heats and cools the heat transfer member at a rate of about 0.25 to 2°C/sec.

A. The Examiner Has Not Identified a Heat Transfer Member Having a Maximum Thickness of About ¼ Inch Including at Least One Flow Passage Through Which Liquid is Circulated to Heat and Cool in the Cited References

The claim feature of a "heat transfer member having a maximum thickness of about ¼ inch, the heat transfer member including at least one flow passage through which a liquid can be circulated to heat and cool the heat transfer member" with "heating is performed solely by the heat transfer member" is missing from the cited references, as explained below.

1. Heating is Performed by Heating Elements in the Applied References

Ramanan discloses a bakeplate **20**, which holds semiconductor device **12**, and includes "one or more heating elements ... preferably in the form of resistive heating element[s]" (emphasis added) (column 13, lines 43-45).

Chiang discloses that the temperature of a substrate can be modulated by heating or cooling electrostatic chuck (ESC) **6** (column 9, lines 48-49). To heat ESC **6**, power is supplied to resistive heater **72** (column 9, lines 53-56). Chiang provides

no disclosure that heated fluid flows into coolant channels **78**. The Examiner's contention that Chiang controls the flow of liquid in member **110** of the substrate support to control "heating" is in error.

In order to modify Yatsuda to obtain the substrate support recited in Claims 1 and 15, it is necessary to: (1) reduce the dimensions of worktable **18**; (2) install a heating liquid to flow through cooling jacket **34**; such that (3) liquid circulating through worktable **18** heats and cools at a rate of about 0.25 to 2°C/sec. However, both Ramanan and Chiang require resistive heating elements in addition to a massive cooling structure. As such, neither Ramanan nor Chiang provides a disclosure or suggestion of a "heat transfer member including at least one flow passage through which a liquid can be circulated to heat ... the heat transfer member" with "heating is performed solely by the heat transfer member." Therefore, this is no suggestion in the secondary references to lead a person of ordinary skill to modify Yatsuda such that worktable **18** is reduced in size to a maximum thickness of about ¼ inch that heats and cools worktable **18** at a rate of about 0.25 to 2°C/sec.

2. <u>The Applied References Disclose a Thermally Massive Cooling Member Maintained at a Constant Temperature</u>

Yatsuda discloses a thermally massive aluminum worktable **18** for a plasma etching apparatus **14** (column 3, lines 17-28; FIG. 1), in which worktable **18** supports semiconductor wafer W (column 3, lines 34-39). Cooling jacket passage **34** in worktable **18** maintains wafer W "at a predetermined temperature by causing a coolant to flow in the jacket **34**" (column 3, lines 53-55). Accordingly, worktable **18** is not is intended for heating and cooling at a rate of about 0.25 to 2°C/sec.

Likewise, Ramanan also discloses a separate metallic cooling member **26** with cooling channels **28** (column 13, lines 59-67), in which the metallic cooling

member **26** is characterized as having a "high thermal mass," such that the ratio of the thermal capacity of cooling member **26** to the bakeplate **20** is preferably at least 10:1 and as high as 100:1 (column 13, lines 24-27). Cooling member **26** is maintained at a desired cooling temperature to provide for chilling (e.g., 15°C to 23°C) (column 13, lines 59-61). Accordingly, contrary to the Examiner's position, Ramanan teaches a cooling member **26** with a high thermal mass, rather than having a maximum thickness of about ¼ inch.

Likewise, Chiang also discloses a massive cooling block in the form of cooling plate **100** attached to baseplate **112** with a plurality of cooling channels **78** (column 21, lines 6-14; FIG. 27A).

Thus, Yatsuda, Ramanan and Chiang disclose thermally massive cooling members for maintaining a fixed temperature and resistive heating members to heat a substrate, rather than a "heat transfer member having a maximum thickness of about ¼ inch, the heat transfer member including at least one flow passage through which a liquid can be circulated" or circulating liquid "to heat and cool the heat transfer member at a rate of from about 0.25-2 °C/sec."

Furthermore, the applied references require separate and distinct heating components, rather than a single heat transfer member capable of both heating and cooling. Accordingly, the cited references fail to teach the claimed substrate support and the rejection should be reversed.

B. <u>The Examiner Has Not Identified a Substrate Support Through Which Liquid Can Be Circulated to Heat and Cool the Heat Transfer Member at a Rate of About 0.25 to 2°C/Second</u>

Ramanan discloses a control system for heating or chilling rates between 1°C/second to 50°C/second (column 4, lines 50-54). However, to achieve this rapid

heating or chilling, it is necessary for the control system to be used in conjunction with "low thermal mass" bakeplate **20** of Ramanan with heating elements (column 13, lines 43-48; column 4, lines 55-59) coupled with "thermally massive" cooling member **26** (column 13, lines 59-65; column 5, lines 30-42). The heating or chilling rates of 1°C/second to 50°C/second are achieved by resistively heating bakeplate **20** (column 13, lines 43-52) or contacting it with "thermally massive heat sink" cooling member **26** (column 13, lines 59-66). There is no suggestion in Ramanan of a single heat transfer member that can be heated or cooled "at a rate of from about 0.25-2 °C/sec." Accordingly, the cited references fail to teach the claimed substrate support and the rejection should be reversed.

C. The Examiner Has Misapplied Gaylord - Claims 32 and 33

The Examiner's Answer has not identified any disclosure in Gaylord that corresponds to the claim feature of "wherein the temperature of the heat transfer member is (i) ramped from the first temperature to the second temperature, or (ii) changed step-wise from the first temperature to the second temperature" during processing of a substrate (Examiner's Answer at page 33, ¶2-3). In Gaylord, a wafer in processed in barrel reactor **11** at a single temperature (column 7, lines 4-8). Upon completion of processing, when the barrel reactor **11** is inactive, it is cooled to a second temperature (column 7, lines 4-8). Accordingly, the cited references fail to teach the claimed substrate support and the rejection should be reversed.

D. Conclusion

For the foregoing reasons, reversal of the rejections of Claims 1-3, 5-29, 32 and 33 is respectfully requested.

Respectfully submitted,

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